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Substance use and risky sexual behavior for exposure to HIV: Issues in methodology, interpretation, and prevention

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Abstract

Recent reports have suggested that the use of alcohol or drugs is related to sexual behavior that is high-risk for HIV infection. If substance use leads to unsafe sexual activity, understanding the dynamics of this relationship can contribute to research, preventive and education efforts to contain the spread of AIDS. In this paper, we review research on the relationship between substance use and high-risk sexual behavior. We then consider the inherent limitations of the research designs used to study this relationship, outline some methodological concerns including measurement and sampling issues, and comment on causal interpretations of correlational research findings. We end with a consideration of potential avenues for future research and a discussion of implications of these findings for current AIDS prevention policies.

As the United States enters the second decade of the AIDS epidemic, it has become evident that the primary defense against the spread of this disease is prevention of the behaviors that result in HIV transmission. Recent behavioral research has focused on identification of potentially modifiable variables that may contribute to risk-taking behaviors. One factor that has been proposed as a contributor to sexual risk-taking is the use of alcohol or other drugs with sex (see Leigh, 1990a; Stall, 1988). Because alcohol and drugs are thought to interfere with judgment and decision-making, it has been suggested that their use in conjunction with sexual activity might increase the probability that risky behaviors will occur (e.g., Howard et al., 1988; USDHHS, 1991). In the last few years, a number of reports have appeared suggesting a link between alcohol or drug use and sexual behavior, such as unprotected intercourse, that is known to place an individual at higher risk for HIV infection.

In this paper we examine the evidence for and against the hypothesis that a causal relationship exists between alcohol and/or drug use and high-risk sexual behavior for HIV transmission. First, we review research that examines the link between substance use and high-risk behavior, while discussing the limitations of the research designs used to investigate this link. We then consider additional methodological concerns, including measurement and sampling issues, that affect interpretation of research findings. We end with a discussion of implications of these findings for AIDS prevention policies.

Research designs and summary of findings

Any discussion of research on the relationship of substance use to sexual risk-taking must take into account the limitations of research methods used. The ideal method for testing whether any drug causes individuals to engage in high-risk sex would be a study in which the drug is administered to an experimental group and withheld from a control group. Such controlled laboratory experiments have been used to investigate the influence of alcohol on various physiological and psychological arousal responses to sexual stimuli (see Crowe & George, 1989 for review). However, it is impossible (for both ethical and practical reasons) to design a controlled experiment to study the influence of a drug on actual sexual behavior in a natural setting -- much as researchers might dream bemusedly of studies in which they randomly assign some bar patrons to drink alcohol, others to drink soft drinks, and then watch what happens.

Analyses of the relationship between substance use and high-risk sex fall into three broad categories.¹ In the first type of study, measures of overall substance use (for example, quantity or frequency of use) and measures of risky sexual behaviors (for example, frequency of engaging in unprotected intercourse) are collected, and the relationship between these two variables is examined. In this paper, we term these studies global association studies. The second type of study is similar, except that instead of general substance use, the frequency of use of alcohol or drugs in conjunction with sexual activity is measured; we call these studies situational association studies. The third group of studies (event analyses) focuses on discrete sexual events: respondents are asked about the circumstances of a specific sexual encounter, including whether high-risk sex occurred and whether alcohol or drugs were used during that encounter.

Global association studies

Many correlational studies have examined the relationship of substance use to sexual behavior in general, showing that general drinking habits are correlated with more liberal sexual behavior (see Wilsnack, 1984), and that recreational drug use is associated with early sexual activity in adolescents (see Kandel, 1989). The existence of a global association between substance use and general sexual activity does not necessarily indicate a link between substance use and risky sexual activity in particular. For example, heavier drinkers may have more frequent sex but not more frequent risky sex; this distinction cannot be determined from data on general patterns of sexual activity. Thus, we begin our review with studies that includes measures specifically of higher-risk sex.

In these studies, respondents were asked about the frequency with which they engaged in high-risk behaviors (in some studies, a dichotomous variable reflecting whether the respondent had engaged in any high-risk activities or not), and about the overall frequency and/or quantity of their alcohol or drug use. The majority, but by no means all, of these studies have shown that people who are heavier drinkers or drug users tend to have more sexual partners and to use condoms less consistently (see Appendix for a listing of the studies reviewed). There are two major limitations of this sort of analysis. First, these studies are unable to demonstrate whether substance use has a direct, causal effect on risky sexual behavior: The results can be equally well-explained by positing that an underlying tendency toward sensation-seeking, risk-taking, or impulsivity leads people both to use substances and to have riskier sex. This interpretation

¹We included in this review only articles published in English. Most of the studies reviewed were conducted in the United States. Exceptions are the studies by Darke et al. (1990), Darke, Baker et al. (1992), Darke, Hall et al. (1992), Gold & Skinner, (1992), Gold et al. (1991), Rosenthal et al. (1991) -- **Australia**; MacDonald et al. (1990) -- **Canada**; Arya et al. (1978), Gold et al. (1992), Klee et al. (1990), McEwan et al. (1992), Weatherburn et al. (1993) -- **England**; Choquet & Manfredi (1992) -- **France**; Halsey et al. (1992) -- **Haiti**; Hartgers et al. (1992) -- **Netherlands**; Kraft & Rise, 1991, Kraft, Rise, & Traeen, 1990; Prieur (1990) -- **Norway**; Bagnall et al. (1990), Plant et al. (1990), Robertson & Plant (1988), Thomas et al. (1990) -- **Scotland**.

is supported by the fact that smoking -- not conventionally regarded as a causal factor in lapses of judgment -- is also highly correlated with high-risk sexual activities (e.g., Biglan et al., 1990; Ekstrand & Coates, 1990; McEwan, McCallum, Bhopal & Madhok, 1992). Second, these studies assess only general substance use, and not frequency of substance use with sex: It is unknown whether people who are heavier users in general also are more likely to have sex while under the influence. It is possible, for example, for a frequent drinker to have frequent high-risk sex, but for the high-risk sex to occur mostly on non-drinking occasions. Measuring the use of substances in conjunction with sexual activity is a feature of the next group of studies that we consider.

Situational association studies

Situational association studies examine the relationship between high-risk sex and the use of substances at the same time as sexual activity (see Appendix for listing). The high-risk sex measure consisted of either the frequency of engaging in high-risk activities or a dichotomous measure reflecting whether the person performed or did not perform a high-risk sexual behavior in a certain time period. Substance use measures consisted of questions about how often the respondent engaged in sex while using alcohol or drugs, or a dichotomous measure of whether the respondent ever used alcohol or drugs with sex. The trend in these findings is similar to that of global association studies: The use of alcohol or drugs with sexual activity is related to the frequency of high-risk sexual behaviors, although many null findings exist.

Although these situational association studies represent a more focused examination of the relationship of substance use to high-risk sex, these data are still limited. The relationship of substance use-with-sex to risky behavior may be an artifact of the relationship between the total amount of sex and the total amount of risky behavior. For example, suppose a person uses alcohol or drugs during 10% of his/her sexual encounters, and has unsafe sex during 10% (not necessarily the same 10%) of his/her sexual encounters. As this person's total number of sexual encounters increases, so do both the number of unsafe encounters and the number of encounters that involve alcohol or drugs. In other words, the more times a person has sex, the more chances s/he has both to engage in risky behavior and to use substances while doing it (Leigh, 1990b). Using a measure of the proportion of times a person had sex while using substances corrects for this problem, and has been used by some researchers (e.g., Leigh, 1990b; Martin, 1990; Valdiserri et al., 1988).

A second limitation of these correlational data is that they do not establish that substance use and risky sex occurred on the same occasion: We cannot know from these data whether the times that an individual used alcohol or drugs with sex were the same times that s/he engaged in risky behaviors. Without such information on the co-occurrence of substance use and high-risk activities, any inferences about causal relationships are impossible (Cooper, Skinner, & George, 1990).

Event analyses

A third type of study ensures the temporal contiguity of substance use and sexual behavior by using a "critical incident" technique, in which respondents are asked a number of questions about a specific sexual incident. The target incident in some studies is the respondent's first sexual experience; in others, the most recent sexual encounter; in others, the most recent experience with a non-monogamous sexual partner. Information is gathered on the occurrence of unsafe and "safer" activities, and on the presence or absence of alcohol or drugs in these events. These studies (see Appendix) have found that the use of alcohol is related to nonuse of contraception at first intercourse; however, several studies of more recent encounters show indicate no relationship of substance use to the use of condoms or other contraceptives.

Because these incident-level studies use a technique that ensures that substance use and sexual activity are temporally paired, they represent an improvement over global association or situational association studies. However, the use of this event-specific information does not eliminate the possibility of confounding personality characteristics (Cooper, Skinner, & George, 1990). A general predisposition to risk-taking, for example, may influence both substance use and risky sex, not only on a gross frequency level, but within specific events: Risk-takers may be more likely to use alcohol or drugs on any given occasion and more likely to engage in unprotected intercourse on any given occasion. Information about a specific encounter does not tell us whether individuals who are predisposed to risky behavior are more likely to engage in unprotected intercourse when they are drinking than when they are not. However, if each respondent provides information on both events that include substance use and events that do not, it is possible to perform a within-subjects analysis comparing substance-using events to no-substance events. Because an individual's personality characteristics are unlikely to change from event to event (assuming, of course, a relatively short time between sexual encounters), a within-subjects analysis holds relevant individual differences constant. Of five published studies that have assessed more than one event per individual, four have shown no differences in unprotected sex between events including and not including drinking (Harvey & Beckman, 1986; Leigh, 1993) or in alcohol use between risky and safer events (Gold & Skinner, 1992; Gold, Skinner, Grant, & Plummer, 1991; but see Gold, Karmiloff-Smith, Skinner, & Morton, 1992 for a contrary example). In one study (Leigh, 1993), a within-subjects analysis showed no relationship of alcohol consumption and condom use, but an across-subjects correlation showed a positive relationship of overall frequency of drinking with sex and overall frequency of condom use. This finding highlights the possibility that third variables may be responsible for the findings of correlational studies.

Conclusions from this research

There are several difficulties with drawing conclusions from these studies. First, there are many inconsistencies in the manner in which substance use and risk are measured. For example, sexual risk has been conceptualized as frequency of unprotected anal intercourse (e.g., McCusker et al., 1989), number of sexual partners (e.g., McKirnan & Peterson, 1989), general condom use (e.g., Hingson, Strunin, Berlin, & Heeren, 1990), or a summary risk variable constructed from a number of behaviors such as number of partners, unprotected sex, and sex with "unsafe" partners such as IV drug users (e.g., Biglan et al., 1990). Alcohol and drug use has been variously defined as number of drugs used (e.g., Ostrow et al., 1990) or any use of alcohol or drugs (e.g., Kelly, St. Lawrence, & Brasfield, 1991), or has been measured using more detailed quantity-frequency measures (e.g., Temple & Leigh, 1992). The measures used in some studies (e.g., Kelly, St. Lawrence, & Brasfield, 1991; Valdiserri et al., 1988) have not separated alcohol intoxication from drug intoxication.

A second interpretational difficulty arises when we consider that some analyses compare only the extremes of distributions: for example, Hingson et al. (1990) compared condom use of nondrinkers vs. those who drank five or more drinks per day, and Valdiserri et al. (1988) compared respondents who never used condoms to those who always used condoms. Although presenting data from only the endpoints of these distributions leads to a more powerful analysis and presentation, it makes it difficult to speculate about how the variables are related at all points of the spectrum. In addition, the variability and distributions of both substance use and sexual variables are likely to differ between samples. For example, the range and variability in number of sexual partners and extent of substance use among gay male respondents is likely to be larger than among a sample of 12 to 17-year olds. If either or both variables have a restricted range, as they would in samples in which either no one is engaging in a behavior or everyone is doing it, the resulting correlations of these variables would be attenuated and null results would occur due to this lack of variability. Finally, there are many differences among

these studies in population characteristics, sampling method, geographical location, and time of data collection that may add much variability to the results. We discuss these issues more fully in the next section.

Despite these difficulties, it is clear that there is a positive relationship between substance use and high-risk sex; what is less clear is the level at which this link exists. People who drink more, use more drugs, or do either in conjunction with sex are more likely to engage in high-risk activities. However, results from analyses of specific sexual incidents have only sometimes shown that alcohol or drug use in a particular sexual encounter is associated with the occurrence of risky activities in that encounter. None of the research methods used permits a causal interpretation of the findings.

Methodological issues

Aside from the limitations inherent in particular research designs, other methodological issues can also influence these research findings and their interpretation. Important methodological considerations include (but may not be limited to) approaches to measurement, population and sampling issues, and the possibility of time-bound phenomena, each of which might affect the probability that a study will detect a relationship between intoxication and high-risk sex.

Measurement

As we have noted, research on substance use and high-risk sex has made use of a wide variety of measurement strategies. Unfortunately, a "gold standard" of measurement does not exist, either in alcohol/drug studies or in studies of sexual behavior. Among adults, both substance use and sexual activity are common enough that individual instances become indistinguishable in memory and may not be easily remembered; frequency reports are then likely to be constructed not by counting discrete events but by way of some kind of inference rule (Schwarz, 1990). Questions about both activities are highly personal and are assumed to result in under-, rather than over-reporting (Blair, Sudman, Bradburn, & Stocking, 1977; Bradburn, Sudman, & Blair, 1979; Miller, Turner, & Moses, 1990). In the absence of non-invasive and ecologically valid biological or observational techniques, measurement of both behaviors must rely on self-reports. Measurement issues have been the focus of much discussion among researchers studying sexual behavior (Catania, Gibson, Chitwood, & Coates, 1990; Miller et al., 1990) and alcohol use (Babor, Stephens, & Marlatt, 1987; Midanik, 1988, 1989; Room, 1990), and both fields have also seen ongoing calls for more research on these issues (Catania et al., 1990; Miller et al., 1990; Midanik, 1989).

Three issues deserve attention when measuring the intersection of these behaviors. First, given that measurement of each behavior is subject to bias and error separately, what is the result when the two measures are correlated and error is thus compounded? Theoretically, compounding of random error would create increased "noise" and decrease the power of the analysis, making significant findings more difficult to obtain. The magnitude of this bias toward the null may be non-linear insofar as it depends on the absolute value of the measure; thus, more error may occur as true frequency increases, because individual episodes become less distinctive (Martin & Vance, 1984; see also Catania et al., 1990). Alternatively, it is possible that the correlation between measures of substance use and of sexual behavior might be spuriously inflated due to correlated error. That is, some part of the correlation of quantity and/or frequency of substance use with frequency of high-risk sex may be due to the fact that they share common sources of bias, including social desirability and self-presentation biases, or method bias due to self-report.

Second, not only are retrospective measures of both substance use and sexual behavior subject to memory errors such as forgetting and telescoping (e.g., Feinberg & Tanur, 1983), but

additional problems may arise in assessing memory for incidents that include both substance use and high-risk sex. Laboratory studies on the effect of alcohol on memory have demonstrated that alcohol interferes with consolidation of information into long-term memory storage (e.g., Birnbaum & Parker, 1977), and state-dependent learning effects have been demonstrated for other drugs as well (e.g., Eich, 1977). Substance use at the time of a sexual encounter may then interfere with the process by which information about that event is stored in memory, such that memory for the specifics of the event is incomplete or biased.

Finally, retrospective summaries of occurrences of unprotected intercourse, and people's accounts of the role of substance use in those occurrences, may be subject to attributional biases. As noted earlier, reports of frequencies of a behavior do not represent accurate counts, but are constructed with various theory-driven inference strategies (Schwarz, 1990). When asked about their past behavior, people may employ everyday theories about cause and effect (Nisbett & Ross, 1980), including the theory that alcohol and drugs cause people to lose their heads. Indeed, gay and bisexual men (Lovejoy & Moran, 1988) and high school students (Kasen, Vaughan, & Walter, 1992) report that they are uncertain of their ability to engage in safe sex while under the influence of alcohol or drugs. Thus, if people are asked "How often do you use a condom when you aren't drinking (never/sometimes/always)" and "How often do you use a condom when you are drinking (never/sometimes/always)" (Hingson et al., 1990), the belief that alcohol interferes with condom use may result in an underreporting of condom use with drinking.

Moreover, when describing and attempting to account for past indiscretions, people tend to present themselves in the best possible light (e.g., Greenwald, 1980). To the extent that intoxication from alcohol or drugs serves as an excuse for unacceptable behavior (Critchlow, 1983; Lang, 1985), people may attribute their lapses in sexual judgment to substance use even if such use was not the true cause (see also Snyder, Higgins, & Stucky, 1983 on excuse-making in general). The operation of such a self-justification bias is consistent with the findings of studies that have asked people their reasons for engaging in unprotected sex. Some studies of focus groups have reported that when people were asked about reasons for past instances of unprotected intercourse in general, impairment from alcohol or drugs was a major factor that arose in the discussion (e.g., Williams, Kimble, Hertzog, Newton, & Fisher, 1991). However, other studies found that when people were questioned about only the most recent occurrence of unprotected intercourse, only a very small proportion (usually less than 5%) reported that they failed to use protection because they were high (Doll, 1989; Leigh, 1989; Stall et al., 1990). Examining a single sexual encounter per person may be misleading insofar as that encounter may not be representative of all of the person's previous encounters; however, asking people to account for their behavior in the aggregate may lead to an inflation of attributions to substance-induced intoxication.

Population and sampling issues

Until very recently, studies of AIDS risk behaviors have predominantly relied on convenience sampling. (Although some large-scale surveys of sexual behavior in representative samples exist [e.g., Smith, 1991], many of these have included only a few general questions about sex, and not detailed measures of "safe" and "unsafe" behavior.) Samples have been recruited from a variety of sources, including bars and bathhouses (e.g., Stall et al., 1986), advertisements (e.g., McKirnan & Peterson, 1989; Siegel, Mesagno, Chen, & Christ, 1989) and gay organizations (e.g., Martin, 1990). Because such samples may not be representative of the general population of homosexuals or heterosexuals, these studies are limited in terms of generalizability -- not only in terms of prevalence estimates of substance use and sexual behavior, but possibly in terms of the relationship between the two. For example, samples recruited from bars might contain a larger proportion of people who regularly combine

substance use and sex, and who engage in more risky sex in general, thus leading to an inflated estimate of the relationship of substance use to high-risk sex. Indeed, some studies have demonstrated a significant positive relationship between the frequency of bargaining and level of high-risk sex (e.g., Ruefli, Yu, & Barton, 1992).

Most research on sexual risk-taking in terms of HIV infection has been conducted among samples drawn from small geographic areas and/or within cities heavily affected by the AIDS epidemic. Overall levels of risk are different in different areas of the country, and correlates of risk (including substance use) may be different as well. Locales differ in terms of their laws regulating alcohol availability, severity of drunk driving laws, and the geographical clustering of "hot spots" such as bars or discos. For example, Gold et al. (1991), in a study of gay men in Melbourne, Australia, found that alcohol consumption was not significantly associated with unsafe sex. However, Gold (1991) subsequently noted that in Melbourne, drinking might be constrained by the need to avoid driving while intoxicated. In Sydney, on the other hand, gay bars are concentrated in one area of town, and many gay men live within walking distance; moreover, taxis are cheaper in Sydney than in Melbourne. Gold (1991) replicated the Melbourne study in Sydney, and found that the Sydney sample tended to be more intoxicated at the time of sexual activity than the Melbourne sample, and that alcohol intoxication was related to the occurrence of unsafe sex among respondents who were not infected with HIV. A stronger relationship of substance use to unsafe sex might thus be more apparent in locations in which both substances and sexual partners are easily obtainable.

Sampling issues include not only general questions of representativeness, but also the possibility that a substance use/high-risk sex link may be different in different populations. There are several characteristics that might moderate any relationship between substance use and risky sex, including age, gender, and sexual orientation; we have discussed these issues elsewhere (Leigh, 1990c; Leigh & Morrison, 1991; Trocki & Leigh, 1991).

Time of data collection

Since the early days of the AIDS epidemic, rates of high-risk sexual behavior among gay men in major AIDS epicenters have declined (see Becker & Joseph, 1988; Stall, Coates, & Hoff, 1988). With these declines, variance is truncated and statistical power to detect relationships between high-risk behavior and its predictors also declines. Furthermore, in major urban areas, these reductions have been accompanied by decreases in the use and abuse of alcohol and drugs (Martin, Dean, Garcia, & Hall, 1989; Paul, Bloomfield, & Stall, 1991). In addition, since the time of the publication of the first study documenting an association of substance use and high-risk sex with respect to AIDS (Stall et al., 1986), public education messages and advertisements appearing in several urban areas have begun to warn against combining substance use with sex. Martin (1990) has provided trend data that suggest that the relationship of substance use to unprotected sex among gay men has attenuated. These findings may represent a true change in the substance use/risky sex link, or they may reflect a decline in power due to decreased variance in both variables, or they may be a manifestation of changes in some third variable (e.g., an increase in general health-consciousness) that motivated decreases in both substance use and high-risk sex.²

²We note that the existence of a longitudinal relationship between substance use and high-risk sex does not necessarily shed additional light on causal relationships. For example, if substance use at Time 1 and 2 are strongly correlated with each other, if risk behavior is similarly correlated over time, and if there is a cross-sectional correlation of substance use to risk behavior, a correlation of substance use at Time 1 with risk behavior at Time 2 may reflect merely a relationship of substance use to high-risk sex at each time point. The longitudinal predictive power of substance use would be more convincing if it could be shown that the relationship remained when all cross-sectional relationships were controlled. In addition, change in both variables may result from underlying motivational tendencies (such as a change in general health-consciousness) or more coincidental factors (such as stopping going to bars, where both substance use and high-risk sex may occur).

In summary, there are a number of methodological limitations to existing research on the relationship of substance use to high-risk sex that hamper the ability to draw coherent conclusions. Measures of both substance use and sexual activity are subject to the limitations of human memory, measurement error, and attributional bias. Changes in risk behavior and rates of combining substance use with sexual activity complicate analyses by decreasing variability and statistical power. Moreover, certain characteristics of the samples studied, including age, geographical location, gender, and sexual orientation, may affect levels of substance use, sexual activity, and their intersection. All of these considerations should be weighed when attempting to draw conclusions about the relationship of substance use and high-risk sex.

Issues of interpretation and prevention

Given the limitations of methods available to researchers, we are far from being able to make statements about the causal nature of the relationship between substance use and high-risk sex. Research findings are consistent with a number of explanations -- causal, correlational, cultural, and coincidental (see Ostrow, 1986; Stall et al., 1986; Leigh, 1990a for discussion). These various explanations emphasize very different factors, from pharmacological disinhibition (see Crowe & George, 1989; Room & Collins, 1983), to cognitive decrements (Pernanen, 1976; Steele & Southwick, 1985), risk-taking or sensation-seeking personality tendencies (Adlaf & Smart, 1983; Zuckerman, 1979), "problem behavior syndrome" (Donovan & Jessor, 1985; Osgood, Johnston, O'Malley & Bachman, 1988), to expectations about the effects of alcohol (see Wilson, 1978), the use of intoxication as an excuse for unacceptable behavior (Critchlow, 1983; Lang, 1985; MacAndrew & Edgerton, 1969), or the role of situation-specific rituals (Stall et al., 1986; Wilson, 1981).

Clearly, a number of plausible explanations, both causal and non-causal, exist for a relationship of substance use to unsafe sex. In some empirical reports, however, the discussion of a correlational relationship between substance use and risky sex is followed by a recommendation that interventions designed to prevent risky sex include a component of substance use prevention; clearly, such a suggestion implies that the researcher assumes a causal relationship between substance use and unsafe sex.³ This causal orientation is echoed in several health education campaigns that have incorporated messages about the dangers of having sex under the influence. For example, a series of advertisements and public service announcements from the National Institute on Drug Abuse (NIDA), targeted at teenagers, focuses on the message that using alcohol or drugs clouds judgment, thereby leading directly to sexual behavior that might expose them to HIV ("New ads," 1991; "Teenagers told," 1990). These messages reflect an assumption that the use of alcohol or drugs directly causes people to engage in risky sex, but such a conclusion cannot validly be drawn from the evidence that is currently available. As Enoch Gordis, director of the National Institute on Alcohol Abuse and Alcoholism (NIAAA), explained, "it is important to understand [that] the fact that [people] are drinking and doing 10 other dumb things, and also doing dumb sex, as a whole does not prove alcohol is responsible for the misjudgments in sexual behavior" ("Dumb drinking," 1990, p. 4).

It appears, however, that some health education messages do presume a causal relationship of substance use to risky sex, and herein lies reason for caution. Given the tendency in our culture to attribute bad behavior to substance use (e.g., MacAndrew & Edgerton, 1969), health

³The assumption that sexual activity under the influence of substances is risky has led in some empirical studies to a confounding of independent (substance use) and dependent (high-risk sex) variables; for example, by including sex under the influence of substances as a measure of risk (e.g., Fullilove et al., 1990). This makes some analyses of the relationship of substance use to high-risk sex somewhat tautological.

education messages that reflect the view that inebriated sex must be high-risk sex may well have counterproductive effects. First, by highlighting the power of substances to cause high-risk sex, such messages may actually provide a convenient mechanism to avoid personal responsibility for engaging in risky sex. By targeting alcohol or drugs as the cause of harmful behavior, actions that take place under the influence are explained with reference to the substance rather than the individual. Thus, by believing that alcohol and drugs make people act badly, we give them a great deal of power. Their use can become a tool that legitimates and excuses certain behaviors without destroying the moral character of either the individual or the society (see Critchlow, 1986; Room, 1980). Second, especially at this stage of the epidemic, many individuals have learned to have safe sex consistently, regardless of their state of inebriation. Thus, for these people, statements to the effect that intoxicated sex is high-risk sex are clearly not true. Such messages may then may cause important segments of the intended audience to discount the larger package of health education messages, in the same way that an earlier generation discounted governmental warnings concerning the dangers of marijuana use when they discovered that those warnings contradicted their personal experience.

Future directions for research

We have argued that the limitations of existing research make it currently impossible to draw causal conclusions about the association of substance use to high-risk sex. Given the difficulty of implementing experimental studies, and the likely existence of confounding variables of many kinds (personality, social, contextual), we may never see a critical test of a causal hypothesis. However, although cursory inferences of causality made based on correlational findings do not advance knowledge in this domain, establishing causality may not be a necessary condition for progress in research, nor for the application of research findings to public health. As we have discussed elsewhere (Stall & Leigh, in press), there are several alternative research agendas that could expand our understanding of the relationships between these behaviors. Each of these approaches places a different degree of emphasis on issues of causality and on the tradeoff of theoretical and practical considerations.

First, correlational studies could be carefully designed to identify underlying variables that might drive the association of substance use and risky sex, and to test the pathways among these variables. A number of sophisticated statistical procedures are available to disentangle direct and indirect effects -- although we do need to withstand the temptation to believe that this "causal" modeling assures that the relationships it uncovers are truly causal. Studies that have used such an approach have found that the association between substance use and high-risk sexual activity disappears or is attenuated when some risk predispositions are accounted for (e.g., Gillmore, Butler, Lohr, & Gilchrist, 1992; Temple & Leigh, 1992). Research of this kind can suggest important new directions to the extent that it is based on theory rather than empirical shotgunning, and existing theories suggest a number of interesting hypotheses.

A second approach moves away from causal issues and instead focuses simply on the observation of an association of substance use and high-risk sex. If there is such an association, whether causal or non-causal, an intervention that lowers levels of substance use might also decrease levels of participation in high-risk sexual activities. Such a result might occur because of the causal influence of substance use in high-risk sex, or because of a change in some other variable in the causal pathway (such as general health-consciousness) that affects both substance use and sexual activity. A successful demonstration of this sort would show the practical applications of specifying associations of substance use and risky sex, irrespective of the probable existence of confounding variables between the independent and dependent variables.

Finally, the abuse of alcohol or drugs might be seen as a marker for high-risk sexual activity, even in the absence of any causal relationship of substance use to high-risk sex. Over the past decade, several high-risk subpopulations have been identified for specialized AIDS prevention activities, including adolescents and members of racial minorities. Note that the identification and targeting of such groups has never depended on causal arguments: for example, no one asserts that age or race *per se* causes elevated risk. Instead, the characteristics of these groups are assumed to represent markers for a complex set of social and psychological variables that result in higher risk. Similarly, substance abusers might comprise a population of high-risk individuals toward whom AIDS prevention efforts might be directed. Such interventions do not need to be based on an assumption that it is substance use that causes high-risk sexual activity in this group.

Conclusions

There is one conclusion that can be drawn from this literature that will provoke little controversy: Both sex and substance use are complicated behaviors, and determining the nature of the relationship between them is not simple. From a public health standpoint, an understanding of these behaviors is important given that one's view of the cause of a problem determines one's view of its solution. If it is established that substance use is associated with increased AIDS risk, preventive and educational interventions will vary according to the accepted explanation for this relationship. The placing of the locus of the problem -- on the individual, on the drug, or on the environment in which both exist -- implies the acceptance of different kinds of actions taken to solve it. Theory, research, and intervention are thus intertwined.

We see two major obstacles that may impede the exploration of a link between substance use and high-risk sex. The first of these is methodological; measurement limitations could compromise the ability of a study to detect a relationship between substance use and concurrent high-risk sexual activity, or, conversely, increase the probability of detecting a relationship where none actually exists. The second obstacle, ironically, may be the widespread cultural notion that substance use causes disapproved behaviors. With regards to alcohol, the existence of a "malevolence assumption" has been noted (Collins, 1981): The mere presence of alcohol in any sort of untoward event is seen as sufficient evidence to impute cause to the alcohol rather than to other possible factors (see also Room, 1985). We speculate that reliance on conventional wisdom about substance-induced disinhibition hinders progress in this field. An association of substance use and high-risk sex "feels" right, given our folk models of the effects of alcohol and drugs on behavior. If alcohol and drugs are assumed to cause various disapproved sexual behaviors, then research designed to examine the parameters and moderators of a substance use/sex link will not attract the careful scientific attention that we believe it deserves before messages about substance abuse are incorporated into the AIDS prevention armamentarium. If substance use is related -- whether on a causal or a non-causal basis -- to unsafe sexual activity, understanding the dynamics of this relationship becomes a crucial task.

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Appendix

Appendix

Studies that include an analysis of the relationship of substance use to high-risk sexual activity

I. Global association studies: Relationship of general alcohol or drug use to risky sex

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III. Event analyses: Relationship of alcohol or drug use in sexual encounter to risky sex

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